

SEQUENCE LISTING

<110> MOECKEL, Bettina  
BATHE, Brigitte  
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PFEFFERLE, Walter  
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<120> Nucleotide sequences coding for the rpoB gene

<130> 219774US0XCIP

<140> new application  
<141> 2002-02-19

<150> DE 10107229.5  
<151> 2001-02-16

<150> US 09/887052  
<151> 2001-06-25

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<170> PatentIn version 3.1

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| gca ccg cag cgt tat tct ttc gcg aag gtg tcc gca ccc att gag gtg<br>Ala Pro Gln Arg Tyr Ser Phe Ala Lys Val Ser Ala Pro Ile Glu Val | 812  |
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| ccc ggg cta cta gat ctt caa ctg gat tct tac tcc tgg ctg att ggt<br>Pro Gly Leu Leu Asp Leu Gln Leu Asp Ser Tyr Ser Trp Leu Ile Gly | 860  |
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| acg cct gag tgg cgt gct cgt cag aag gaa ttc ggc gag gga gcc<br>Thr Pro Glu Trp Arg Ala Arg Gln Lys Glu Phe Gly Glu Gly Ala         | 908  |
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| cgc gta acc agc ggc ctt gag aac att ctc gag gag ctc tcc cca atc<br>Arg Val Thr Ser Gly Leu Glu Asn Ile Leu Glu Glu Leu Ser Pro Ile | 956  |
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| 150 155 160 165  |      |
| agc cag ctc gtc cgc tcc ccg ggc gtg tac ttt gac cag acc atc gat<br>Ser Gln Leu Val Arg Ser Pro Gly Val Tyr Phe Asp Gln Thr Ile Asp | 1244 |
| 170 175 180  |      |
| aag tca act gag cgt cca ctg cac gcc gtg aag gtt att cct tcc cgt<br>Lys Ser Thr Glu Arg Pro Leu His Ala Val Lys Val Ile Pro Ser Arg | 1292 |
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| ctt ggc tgg acc act gag cag atc acc gag cgt ttc ggt ttc tct gaa<br>Leu Gly Trp Thr Thr Glu Gln Ile Thr Glu Arg Phe Gly Phe Ser Glu<br>230 235 240 245 | 1436 |
| atc atg atg tcc acc ctc gag tcc gat ggt gta gca aac acc gat gag<br>Ile Met Met Ser Thr Leu Glu Ser Asp Gly Val Ala Asn Thr Asp Glu<br>250 255 260     | 1484 |
| gca ttg ctg gag atc tac cgc aag cag cgt cca ggc gag cag cct acc<br>Ala Leu Leu Glu Ile Tyr Arg Lys Gln Arg Pro Gly Glu Gln Pro Thr<br>265 270 275     | 1532 |
| cgc gac ctt gcg cag tcc ctc ctg gac aac agc ttc ttc cgt gca aag<br>Arg Asp Leu Ala Gln Ser Leu Leu Asp Asn Ser Phe Phe Arg Ala Lys<br>280 285 290     | 1580 |
| cgc tac gac ctg gct cgc gtt ggt cgt tac aag atc aac cgc aag ctc<br>Arg Tyr Asp Leu Ala Arg Val Gly Arg Tyr Lys Ile Asn Arg Lys Leu<br>295 300 305     | 1628 |
| ggc ctt ggt ggc gac cac gat ggt ttg atg act ctt act gaa gag gac<br>Gly Leu Gly Gly Asp His Asp Gly Leu Met Thr Leu Thr Glu Glu Asp<br>310 315 320 325 | 1676 |
| atc gca acc acc atc gag tac ctg gtg cgt ctg cac gca ggt gag cgc<br>Ile Ala Thr Thr Ile Glu Tyr Leu Val Arg Leu His Ala Gly Glu Arg<br>330 335 340     | 1724 |
| gtc atg act tct cca aat ggt gaa gag atc cca gtc gag acc gat gac<br>Val Met Thr Ser Pro Asn Gly Glu Ile Pro Val Glu Thr Asp Asp<br>345 350 355         | 1772 |
| atc gac cac ttt ggt aac cgt cgt ctg cgt acc gtt ggc gaa ctg atc<br>Ile Asp His Phe Gly Asn Arg Arg Leu Arg Thr Val Gly Glu Leu Ile<br>360 365 370     | 1820 |
| cag aac cag gtc cgt gtc ggc ctg tcc cgc atg gag cgc gtt gtt cgt<br>Gln Asn Gln Val Arg Val Gly Leu Ser Arg Met Glu Arg Val Val Arg<br>375 380 385     | 1868 |
| gag cgt atg acc acc cag gat gcg gag tcc att act cct act tcc ttg<br>Glu Arg Met Thr Thr Gln Asp Ala Glu Ser Ile Thr Pro Thr Ser Leu<br>390 395 400 405 | 1916 |
| atc aac gtt cgt cct gtc tct gca gct atc cgt gag ttc ttc gga act<br>Ile Asn Val Arg Pro Val Ser Ala Ala Ile Arg Glu Phe Phe Gly Thr<br>410 415 420     | 1964 |
| tcc cag ctg tct cag ttc atg gac cag aac aac tcc ctg tct ggt ttg<br>Ser Gln Leu Ser Gln Phe Met Asp Gln Asn Asn Ser Leu Ser Gly Leu<br>425 430 435     | 2012 |

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|---|-----|------|-----|
| act cac aag cgt cgt ctg tcg gct ctg ggc ccg ggt ggt ctg tcc cgt |     | 2060 |     |
| Thr His Lys Arg Arg Leu Ser Ala Leu Gly Pro Gly Gly Leu Ser Arg |     |      |     |
| 440   | 445 | 450  |     |
| gag cgc gcc ggc atc gag gtt cga gac gtt cac cca tct cac tac ggc |     | 2108 |     |
| Glu Arg Ala Gly Ile Glu Val Arg Asp Val His Pro Ser His Tyr Gly |     |      |     |
| 455   | 460 | 465  |     |
| cgt atg tgc cca att gag act ccg gaa ggt cca aac att ggc ctg atc |     | 2156 |     |
| Arg Met Cys Pro Ile Glu Thr Pro Glu Gly Pro Asn Ile Gly Leu Ile |     |      |     |
| 470   | 475 | 480  | 485 |
| ggt tcc ttg gct tcc tat gct cga gtg aac cca ttc ggt ttc att gag |     | 2204 |     |
| Gly Ser Leu Ala Ser Tyr Ala Arg Val Asn Pro Phe Gly Phe Ile Glu |     |      |     |
| 490   | 495 | 500  |     |
| acc cca tac cgt cgc atc atc gac ggc aag ctg acc gac cag att gac |     | 2252 |     |
| Thr Pro Tyr Arg Arg Ile Ile Asp Gly Lys Leu Thr Asp Gln Ile Asp |     |      |     |
| 505   | 510 | 515  |     |
| tac ctt acc gct gat gag gaa gac cgc ttc gtt gtc cag gca aac     |     | 2300 |     |
| Tyr Leu Thr Ala Asp Glu Glu Asp Arg Phe Val Val Ala Gln Ala Asn |     |      |     |
| 520   | 525 | 530  |     |
| acg cac tac gac gaa gag ggc aac atc acc gat gag acc gtc act gtt |     | 2348 |     |
| Thr His Tyr Asp Glu Glu Gly Asn Ile Thr Asp Glu Thr Val Thr Val |     |      |     |
| 535   | 540 | 545  |     |
| cgt ctg aag gac ggc gac atc gcc atg gtt ggc cgc aac gcg gtt gat |     | 2396 |     |
| Arg Leu Lys Asp Gly Asp Ile Ala Met Val Gly Arg Asn Ala Val Asp |     |      |     |
| 550   | 555 | 560  | 565 |
| tac atg gac gtt tcc cct cgt cag atg gtt tct gtt ggt acc gcg atg |     | 2444 |     |
| Tyr Met Asp Val Ser Pro Arg Gln Met Val Ser Val Gly Thr Ala Met |     |      |     |
| 570   | 575 | 580  |     |
| att cca ttc ctg gag cac gac gat gct aac cgt gca ctg atg ggc gcg |     | 2492 |     |
| Ile Pro Phe Leu Glu His Asp Asp Ala Asn Arg Ala Leu Met Gly Ala |     |      |     |
| 585   | 590 | 595  |     |
| aac atg cag aag cag gct gtg cca ctg att cgt gcc gag gct cct ttc |     | 2540 |     |
| Asn Met Gln Lys Gln Ala Val Pro Leu Ile Arg Ala Glu Ala Pro Phe |     |      |     |
| 600   | 605 | 610  |     |
| gtg ggc acc ggt atg gag cag cgc gca gca tac gac gcc ggc gac ctg |     | 2588 |     |
| Val Gly Thr Gly Met Glu Gln Arg Ala Ala Tyr Asp Ala Gly Asp Leu |     |      |     |
| 615   | 620 | 625  |     |
| gtt att acc cca gtc gca ggt gtg gtg gaa aac gtt tca gct gac ttc |     | 2636 |     |
| Val Ile Thr Pro Val Ala Gly Val Val Glu Asn Val Ser Ala Asp Phe |     |      |     |
| 630   | 635 | 640  | 645 |
| atc acc atc atg gct gat gac ggc aag cgc gaa acc tac ctg ctg cgt |     | 2684 |     |
| Ile Thr Ile Met Ala Asp Asp Gly Lys Arg Glu Thr Tyr Leu Leu Arg |     |      |     |
| 650   | 655 | 660  |     |
| aag ttc cag cgc acc aac cag ggc acc agc tac aac cag aag cct ttg |     | 2732 |     |

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|---|-----|------|-----|
| Lys Phe Gln Arg Thr Asn Gln Gly Thr Ser Tyr Asn Gln Lys Pro Leu |     |      |     |
| 665   | 670 | 675  |     |
| gtt aac ttg ggc gag cgc gtt gaa gct ggc cag gtt att gct gat ggt |     | 2780 |     |
| Val Asn Leu Gly Glu Arg Val Glu Ala Gly Gln Val Ile Ala Asp Gly |     |      |     |
| 680   | 685 | 690  |     |
| cca ggt acc ttc aat ggt gaa atg tcc ctt ggc cgt aac ctt ctg gtt |     | 2828 |     |
| Pro Gly Thr Phe Asn Gly Glu Met Ser Leu Gly Arg Asn Leu Leu Val |     |      |     |
| 695   | 700 | 705  |     |
| gcg ttc atg cct tgg gaa ggc cac aac tac gag gat ggc atc atc ctc |     | 2876 |     |
| Ala Phe Met Pro Trp Glu Gly His Asn Tyr Glu Asp Ala Ile Ile Leu |     |      |     |
| 710   | 715 | 720  | 725 |
| aac cag aac atc gtt gag cag gac atc ttg acc tcg atc cac atc gag |     | 2924 |     |
| Asn Gln Asn Ile Val Glu Gln Asp Ile Leu Thr Ser Ile His Ile Glu |     |      |     |
| 730   | 735 | 740  |     |
| gag cac gag atc gat gcc cgc gac act aag ctt ggc gcc gaa gaa atc |     | 2972 |     |
| Glu His Glu Ile Asp Ala Arg Asp Thr Lys Leu Gly Ala Glu Glu Ile |     |      |     |
| 745   | 750 | 755  |     |
| acc cgc gac atc cct aat gtg tct gaa gaa gtc ctc aag gac ctc gac |     | 3020 |     |
| Thr Arg Asp Ile Pro Asn Val Ser Glu Glu Val Leu Lys Asp Leu Asp |     |      |     |
| 760   | 765 | 770  |     |
| gac cgc ggt att gtc cgc atc ggt gct gat gtt cgt gac ggc gac atc |     | 3068 |     |
| Asp Arg Gly Ile Val Arg Ile Gly Ala Asp Val Arg Asp Gly Asp Ile |     |      |     |
| 775   | 780 | 785  |     |
| ctg gtc ggt aag gtc acc cct aag ggc gag acc gag ctc acc ccg gaa |     | 3116 |     |
| Leu Val Gly Lys Val Thr Pro Lys Gly Glu Thr Glu Leu Thr Pro Glu |     |      |     |
| 790   | 795 | 800  | 805 |
| gag cgc ttg ctg cgc gca atc ttc ggt gag aag gcc cgc gaa gtt cgc |     | 3164 |     |
| Glu Arg Leu Leu Arg Ala Ile Phe Gly Glu Lys Ala Arg Glu Val Arg |     |      |     |
| 810   | 815 | 820  |     |
| gat acc tcc atg aag gtg cct cac ggt gag acc ggc aag gtc atc ggc |     | 3212 |     |
| Asp Thr Ser Met Lys Val Pro His Gly Glu Thr Gly Lys Val Ile Gly |     |      |     |
| 825   | 830 | 835  |     |
| gtg cgt cac ttc tcc cgc gag gac gac gat ctg gct cct ggc gtc     |     | 3260 |     |
| Val Arg His Phe Ser Arg Glu Asp Asp Asp Asp Leu Ala Pro Gly Val |     |      |     |
| 840   | 845 | 850  |     |
| aac gag atg atc cgt atc tac gtt gct cag aag cgt aag atc cag gac |     | 3308 |     |
| Asn Glu Met Ile Arg Ile Tyr Val Ala Gln Lys Arg Lys Ile Gln Asp |     |      |     |
| 855   | 860 | 865  |     |
| ggc gat aag ctc gct ggc cgc cac ggt aac aag ggt gtt gtc ggt aaa |     | 3356 |     |
| Gly Asp Lys Leu Ala Gly Arg His Gly Asn Lys Gly Val Val Gly Lys |     |      |     |
| 870   | 875 | 880  | 885 |
| att ttg cct cag gaa gat atg cca ttc ctt cca gac ggc act cct gtt |     | 3404 |     |
| Ile Leu Pro Gln Glu Asp Met Pro Phe Leu Pro Asp Gly Thr Pro Val |     |      |     |

| 890   | 895  | 900  |      |
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| gac atc atc ttg aac acc cac ggt gtt cca cgt cgt atg aac att ggt<br>Asp Ile Ile Leu Asn Thr His Gly Val Pro Arg Arg Met Asn Ile Gly<br>905 | 910  | 915  | 3452 |
| cag gtt ctt gag acc cac ctt ggc tgg ctg gca tct gct ggt tgg tcc<br>Gln Val Leu Glu Thr His Leu Gly Trp Leu Ala Ser Ala Gly Trp Ser<br>920 | 925  | 930  | 3500 |
| gtg gat cct gaa gat cct gag aac gct gag ctc gtc aag act ctg cct<br>Val Asp Pro Glu Asp Pro Glu Asn Ala Glu Leu Val Lys Thr Leu Pro<br>935 | 940  | 945  | 3548 |
| gca gac ctc ctc gag gtt cct gct ggt tcc ttg act gca act cct gtg<br>Ala Asp Leu Leu Glu Val Pro Ala Gly Ser Leu Thr Ala Thr Pro Val<br>950 | 955  | 960  | 3596 |
| ttc gac ggt gcg tca aac gaa gag ctc gca ggc ctg ctc gct aat tca<br>Phe Asp Gly Ala Ser Asn Glu Glu Leu Ala Gly Leu Leu Ala Asn Ser<br>970 | 975  | 980  | 3644 |
| cgt cca aac cgc gac ggc gac gtc atg gtt aac gcg gat ggt aaa gca<br>Arg Pro Asn Arg Asp Gly Asp Val Met Val Asn Ala Asp Gly Lys Ala<br>985 | 990  | 995  | 3692 |
| acg ctt atc gac ggt cgc tcc ggt gag cct tac ccg tac ccg gtt<br>Thr Leu Ile Asp Gly Arg Ser Gly Glu Pro Tyr Pro Tyr Pro Val<br>1000        | 1005 | 1010 | 3737 |
| tcc atc ggc tac atg tac atg ctg aag ctg cac cac ctc gtt gac<br>Ser Ile Gly Tyr Met Tyr Met Leu Lys Leu His His Leu Val Asp<br>1015        | 1020 | 1025 | 3782 |
| gag aag atc cac gca cgt tcc act ggt cct tac tcc atg att acc<br>Glu Lys Ile His Ala Arg Ser Thr Gly Pro Tyr Ser Met Ile Thr<br>1030        | 1035 | 1040 | 3827 |
| cag cag cca ctg ggt ggt aaa gca cag ttc ggt gga cag cgt ttc<br>Gln Gln Pro Leu Gly Gly Lys Ala Gln Phe Gly Gly Gln Arg Phe<br>1045        | 1050 | 1055 | 3872 |
| ggc gaa atg gag gtg tgg gca atg cag gca tac ggc gct gcc tac<br>Gly Glu Met Glu Val Trp Ala Met Gln Ala Tyr Gly Ala Ala Tyr<br>1060        | 1065 | 1070 | 3917 |
| aca ctt cag gag ctg ctg acc atc aag tct gat gac gtc gtt ggc<br>Thr Leu Gln Glu Leu Leu Thr Ile Lys Ser Asp Asp Val Val Gly<br>1075        | 1080 | 1085 | 3962 |
| cgt gtc aag gtc tac gaa gca att gtg aag ggc gag aac atc ccg<br>Arg Val Lys Val Tyr Glu Ala Ile Val Lys Gly Glu Asn Ile Pro<br>1090        | 1095 | 1100 | 4007 |
| gat cca ggt att cct gag tcc ttc aag gtt ctc ctc aag gag ctc<br>Asp Pro Gly Ile Pro Glu Ser Phe Lys Val Leu Leu Lys Glu Leu<br>1105        | 1110 | 1115 | 4052 |

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| cag tcc ttg tgc ctg aac gtg gag gtt ctc tcc gca gac ggc act         | 4097 |
| Gln Ser Leu Cys Leu Asn Val Glu Val Leu Ser Ala Asp Gly Thr         |      |
| 1120 1125 1130  |      |
| cca atg gag ctc gcg ggt gac gac gac gac ttc gat cag gca ggc         | 4142 |
| Pro Met Glu Leu Ala Gly Asp Asp Asp Asp Phe Asp Gln Ala Gly         |      |
| 1135 1140 1145  |      |
| gcc tca ctt ggc atc aac ctg tcc cgt gac gag cgt tcc gac gcc         | 4187 |
| Ala Ser Leu Gly Ile Asn Leu Ser Arg Asp Glu Arg Ser Asp Ala         |      |
| 1150 1155 1160  |      |
| gac acc gca tagcagatca gaaaacaacc gctagaaaatc aagccataca            | 4236 |
| Asp Thr Ala   |      |
| 1165  |      |
| tcccccggac attgaagaga tggtctgggg gaaaaggag tttacgtgc tcgacgtaaa     | 4296 |
| cgtcttcgat gagctccgca tcggcctggc caccgcccac gacatccgcc gttggtccaa   | 4356 |
| gggtgaggtc aagaagccgg agaccatcaa ctaccgaacc ctcaaggctg agaaggacgg   | 4416 |
| tctgttctgc gagcgtatct tcggccaac tcgcgactgg gagtgcgcct gcggtaagta    | 4476 |
| caagcgtgtc cgctacaagg gcatcatctg tgaacgctgt ggcgttgagg tcaccaagtc   | 4536 |
| caaggtgcgc cgtgagcgca tggcacacat tgagctcgct gcaccagtaa cccacatttg   | 4596 |
| gtacttcaag ggcgttccat cacgcctcgg ctacctttg gaccttgctc caaaggacct    | 4656 |
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| cagcgaccag accactcttggaggcagaat gcttctggag aagaaggacg ttgaggcaga    | 4776 |
| cgcagagtct gacattgctg agcgtgctga aaagctcgaa gaggatcttgc tgaacttgc   | 4836 |
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| gcagcacatc cgtgagcgtg cacagcgcga aatcgatcg tctcgatgagg tctggcagac   | 4956 |
| cttcataag ctgctccaa agcagatgat ccgcgatgag aagctctacg atgaactgat     | 5016 |
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| ccagaacttc gacattgtatg ctg  | 5099 |

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Ala Pro Ile Glu Val Pro Gly Leu Leu Asp Leu Gln Leu Asp Ser Tyr  
35 40 45

Ser Trp Leu Ile Gly Thr Pro Glu Trp Arg Ala Arg Gln Lys Glu Glu  
50 55 60

Phe Gly Glu Gly Ala Arg Val Thr Ser Gly Leu Glu Asn Ile Leu Glu  
65 70 75 80

Glu Leu Ser Pro Ile Gln Asp Tyr Ser Gly Asn Met Ser Leu Ser Leu  
85 90 95

Ser Glu Pro Arg Phe Glu Asp Val Lys Asn Thr Ile Asp Glu Ala Lys  
100 105 110

Glu Lys Asp Ile Asn Tyr Ala Ala Pro Leu Tyr Val Thr Ala Glu Phe  
115 120 125

Val Asn Asn Thr Thr Gly Glu Ile Lys Ser Gln Thr Val Phe Ile Gly  
130 135 140

Asp Phe Pro Met Met Thr Asp Lys Gly Thr Phe Ile Ile Asn Gly Thr  
145 150 155 160

Glu Arg Val Val Val Ser Gln Leu Val Arg Ser Pro Gly Val Tyr Phe  
165 170 175

Asp Gln Thr Ile Asp Lys Ser Thr Glu Arg Pro Leu His Ala Val Lys  
180 185 190

Val Ile Pro Ser Arg Gly Ala Trp Leu Glu Phe Asp Val Asp Lys Arg  
195 200 205

Asp Ser Val Gly Val Arg Ile Asp Arg Lys Arg Arg Gln Pro Val Thr  
210 215 220

Val Leu Leu Lys Ala Leu Gly Trp Thr Thr Glu Gln Ile Thr Glu Arg  
225 230 235 240

Phe Gly Phe Ser Glu Ile Met Met Ser Thr Leu Glu Ser Asp Gly Val  
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260 265 270

Gly Glu Gln Pro Thr Arg Asp Leu Ala Gln Ser Leu Leu Asp Asn Ser  
275 280 285

Phe Phe Arg Ala Lys Arg Tyr Asp Leu Ala Arg Val Gly Arg Tyr Lys  
290 295 300

Ile Asn Arg Lys Leu Gly Leu Gly Gly Asp His Asp Gly Leu Met Thr  
305 310 315 320

Leu Thr Glu Glu Asp Ile Ala Thr Thr Ile Glu Tyr Leu Val Arg Leu  
325 330 335

His Ala Gly Glu Arg Val Met Thr Ser Pro Asn Gly Glu Glu Ile Pro  
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Val Glu Thr Asp Asp Ile Asp His Phe Gly Asn Arg Arg Leu Arg Thr  
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Val Gly Glu Leu Ile Gln Asn Gln Val Arg Val Gly Leu Ser Arg Met  
370 375 380

Glu Arg Val Val Arg Glu Arg Met Thr Thr Gln Asp Ala Glu Ser Ile  
385 390 395 400

Thr Pro Thr Ser Leu Ile Asn Val Arg Pro Val Ser Ala Ala Ile Arg  
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Glu Phe Phe Gly Thr Ser Gln Leu Ser Gln Phe Met Asp Gln Asn Asn  
420 425 430

Ser Leu Ser Gly Leu Thr His Lys Arg Arg Leu Ser Ala Leu Gly Pro  
435 440 445

Gly Gly Leu Ser Arg Glu Arg Ala Gly Ile Glu Val Arg Asp Val His  
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Pro Ser His Tyr Gly Arg Met Cys Pro Ile Glu Thr Pro Glu Gly Pro  
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Asn Ile Gly Leu Ile Gly Ser Leu Ala Ser Tyr Ala Arg Val Asn Pro  
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Phe Gly Phe Ile Glu Thr Pro Tyr Arg Arg Ile Ile Asp Gly Lys Leu  
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Val Ala Gln Ala Asn Thr His Tyr Asp Glu Glu Gly Asn Ile Thr Asp  
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Glu Thr Val Thr Val Arg Leu Lys Asp Gly Asp Ile Ala Met Val Gly  
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Arg Asn Ala Val Asp Tyr Met Asp Val Ser Pro Arg Gln Met Val Ser  
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Val Gly Thr Ala Met Ile Pro Phe Leu Glu His Asp Asp Ala Asn Arg  
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Ala Leu Met Gly Ala Asn Met Gln Lys Gln Ala Val Pro Leu Ile Arg  
595 600 605

Ala Glu Ala Pro Phe Val Gly Thr Gly Met Glu Gln Arg Ala Ala Tyr  
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Asp Ala Gly Asp Leu Val Ile Thr Pro Val Ala Gly Val Val Glu Asn  
625 630 635 640

Val Ser Ala Asp Phe Ile Thr Ile Met Ala Asp Asp Gly Lys Arg Glu  
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Thr Tyr Leu Leu Arg Lys Phe Gln Arg Thr Asn Gln Gly Thr Ser Tyr  
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Asn Gln Lys Pro Leu Val Asn Leu Gly Glu Arg Val Glu Ala Gly Gln  
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Val Ile Ala Asp Gly Pro Gly Thr Phe Asn Gly Glu Met Ser Leu Gly

690

695

700

Arg Asn Leu Leu Val Ala Phe Met Pro Trp Glu Gly His Asn Tyr Glu  
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Asp Ala Ile Ile Leu Asn Gln Asn Ile Val Glu Gln Asp Ile Leu Thr  
725 730 735

Ser Ile His Ile Glu Glu His Glu Ile Asp Ala Arg Asp Thr Lys Leu  
740 745 750

Gly Ala Glu Glu Ile Thr Arg Asp Ile Pro Asn Val Ser Glu Glu Val  
755 760 765

Leu Lys Asp Leu Asp Asp Arg Gly Ile Val Arg Ile Gly Ala Asp Val  
770 775 780

Arg Asp Gly Asp Ile Leu Val Gly Lys Val Thr Pro Lys Gly Glu Thr  
785 790 795 800

Glu Leu Thr Pro Glu Glu Arg Leu Leu Arg Ala Ile Phe Gly Glu Lys  
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Ala Arg Glu Val Arg Asp Thr Ser Met Lys Val Pro His Gly Glu Thr  
820 825 830

Gly Lys Val Ile Gly Val Arg His Phe Ser Arg Glu Asp Asp Asp Asp  
835 840 845

Leu Ala Pro Gly Val Asn Glu Met Ile Arg Ile Tyr Val Ala Gln Lys  
850 855 860

Arg Lys Ile Gln Asp Gly Asp Lys Leu Ala Gly Arg His Gly Asn Lys  
865 870 875 880

Gly Val Val Gly Lys Ile Leu Pro Gln Glu Asp Met Pro Phe Leu Pro  
885 890 895

Asp Gly Thr Pro Val Asp Ile Ile Leu Asn Thr His Gly Val Pro Arg  
900 905 910

Arg Met Asn Ile Gly Gln Val Leu Glu Thr His Leu Gly Trp Leu Ala  
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Ser Ala Gly Trp Ser Val Asp Pro Glu Asp Pro Glu Asn Ala Glu Leu  
930 935 940

Val Lys Thr Leu Pro Ala Asp Leu Leu Glu Val Pro Ala Gly Ser Leu  
945 950 955 960

Thr Ala Thr Pro Val Phe Asp Gly Ala Ser Asn Glu Glu Leu Ala Gly  
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Leu Leu Ala Asn Ser Arg Pro Asn Arg Asp Gly Asp Val Met Val Asn  
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Ala Asp Gly Lys Ala Thr Leu Ile Asp Gly Arg Ser Gly Glu Pro Tyr  
995 1000 1005

Pro Tyr Pro Val Ser Ile Gly Tyr Met Tyr Met Leu Lys Leu His  
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His Leu Val Asp Glu Lys Ile His Ala Arg Ser Thr Gly Pro Tyr  
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Ser Met Ile Thr Gln Gln Pro Leu Gly Gly Lys Ala Gln Phe Gly  
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Gly Ala Ala Tyr Thr Leu Gln Glu Leu Leu Thr Ile Lys Ser Asp  
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Asp Val Val Gly Arg Val Lys Val Tyr Glu Ala Ile Val Lys Gly  
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Glu Asn Ile Pro Asp Pro Gly Ile Pro Glu Ser Phe Lys Val Leu  
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Leu Lys Glu Leu Gln Ser Leu Cys Leu Asn Val Glu Val Leu Ser  
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Ala Asp Gly Thr Pro Met Glu Leu Ala Gly Asp Asp Asp Asp Phe  
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tcgacgcctc cctcgacgat gcagctgtct ctaagctggt tgcacaggcc gaaagcatcc 180  
ctgatggaga tgtgagcaaa atcgcaaata ccgttaggtat tgtgatcggt gcggtattgg 240  
ctctcggtgg cctggccggg tgtttgggg cgtttgggaa gaaacgtcga gaagcttaac 300  
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|  |      |
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| atcaagggtgg tttaaaaaaaaa ccgatttgc aaggcatttc agtgctatct ggagtcgttc  | 600  |
| agggggatcg gttcctcag cagaccaatt gctaaaaat accagcgtg ttgatctgca   | 660  |
| cttaatggcc ttgaccagcc aggtcaatt acccgcgtga g gtg ctg gaa gga ctc<br>Val Leu Glu Gly Leu  | 716  |
| 1 5  |      |
| atc ttg gca gtc tcc cgc cag acc aag tca gtc gtc gat att ccc ggt<br>Ile Leu Ala Val Ser Arg Gln Thr Lys Ser Val Val Asp Ile Pro Gly | 764  |
| 10 15 20   |      |
| gca ccg cag cgt tat tct ttc gcg aag gtg tcc gca ccc att gag gtg<br>Ala Pro Gln Arg Tyr Ser Phe Ala Lys Val Ser Ala Pro Ile Glu Val | 812  |
| 25 30 35   |      |
| ccc ggg cta cta gat ctt caa ctg gat tct tac tcc tgg ctg att ggt<br>Pro Gly Leu Leu Asp Leu Gln Leu Asp Ser Tyr Ser Trp Leu Ile Gly | 860  |
| 40 45 50   |      |
| acg cct gag tgg cgt gct cgt cag aag gaa ttc ggc gag gga gcc<br>Thr Pro Glu Trp Arg Ala Arg Gln Lys Glu Glu Phe Gly Glu Gly Ala     | 908  |
| 55 60 65   |      |
| cgc gta acc agc ggc ctt gag aac att ctc gag gag ctc tcc cca atc<br>Arg Val Thr Ser Gly Leu Glu Asn Ile Leu Glu Glu Leu Ser Pro Ile | 956  |
| 70 75 80 85  |      |
| cag gat tac tct gga aac atg tcc ctg agc ctt tcg gag cca cgc ttc<br>Gln Asp Tyr Ser Gly Asn Met Ser Leu Ser Leu Ser Glu Pro Arg Phe | 1004 |
| 90 95 100  |      |
| gaa gac gtc aag aac acc att gac gag gcg aaa gaa aag gac atc aac<br>Glu Asp Val Lys Asn Thr Ile Asp Glu Ala Lys Glu Lys Asp Ile Asn | 1052 |
| 105 110 115  |      |
| tac gcg gcg cca ctg tat gtg acc gcg gag ttc gtc aac aac acc acc<br>Tyr Ala Ala Pro Leu Tyr Val Thr Ala Glu Phe Val Asn Asn Thr Thr | 1100 |
| 120 125 130  |      |
| ggt gaa atc aag tct cag act gtc ttc atc ggc gat ttc cca atg atg<br>Gly Glu Ile Lys Ser Gln Thr Val Phe Ile Gly Asp Phe Pro Met Met | 1148 |
| 135 140 145  |      |
| acg gac aag gga acg ttc atc atc aac gga acc gaa cgc gtt gtg gtc<br>Thr Asp Lys Gly Thr Phe Ile Ile Asn Gly Thr Glu Arg Val Val Val | 1196 |
| 150 155 160 165  |      |
| agc cag ctc gtc cgc tcc ccg ggc gtg tac ttt gac cag acc atc gat<br>Ser Gln Leu Val Arg Ser Pro Gly Val Tyr Phe Asp Gln Thr Ile Asp | 1244 |
| 170 175 180  |      |
| aag tca act gag cgt cca ctg cac gcc gtg aag gtt att cct ttc cgt<br>Lys Ser Thr Glu Arg Pro Leu His Ala Val Lys Val Ile Pro Phe Arg | 1292 |
| 185 190 195  |      |
| ggt gct tgg ctt gag ttt gac gtc gat aag cgc gat tcg gtt ggt gtt  | 1340 |

|   |     |     |      |
|---|-----|-----|------|
| Gly Ala Trp Leu Glu Phe Asp Val Asp Lys Arg Asp Ser Val Gly Val |     |     |      |
| 200   | 205 | 210 |      |
| cgt att gac cgc aag cgt cgc cag cca gtc acc gta ctg ctg aag gct |     |     | 1388 |
| Arg Ile Asp Arg Lys Arg Arg Gln Pro Val Thr Val Leu Leu Lys Ala |     |     |      |
| 215   | 220 | 225 |      |
| ctt ggc tgg acc act gag cag atc acc gag cgt ttc ggt ttc tct gaa |     |     | 1436 |
| Leu Gly Trp Thr Thr Glu Gln Ile Thr Glu Arg Phe Gly Phe Ser Glu |     |     |      |
| 230   | 235 | 240 | 245  |
| atc atg atg tcc acc ctc gag tcc gat ggt gta gca aac acc gat gag |     |     | 1484 |
| Ile Met Met Ser Thr Leu Glu Ser Asp Gly Val Ala Asn Thr Asp Glu |     |     |      |
| 250   | 255 | 260 |      |
| gca ttg ctg gag atc tac cgc aag cag cgt cca ggc gag cag cct acc |     |     | 1532 |
| Ala Leu Leu Glu Ile Tyr Arg Lys Gln Arg Pro Gly Glu Gln Pro Thr |     |     |      |
| 265   | 270 | 275 |      |
| cgc gac ctt gcg cag tcc ctc ctg gac aac agc ttc ttc cgt gca aag |     |     | 1580 |
| Arg Asp Leu Ala Gln Ser Leu Leu Asp Asn Ser Phe Phe Arg Ala Lys |     |     |      |
| 280   | 285 | 290 |      |
| cgc tac gac ctg gct cgc gtt ggt cgt tac aag atc aac cgc aag ctc |     |     | 1628 |
| Arg Tyr Asp Leu Ala Arg Val Gly Arg Tyr Lys Ile Asn Arg Lys Leu |     |     |      |
| 295   | 300 | 305 |      |
| ggc ctt ggt ggc gac cac gat ggt ttg atg act ctt act gaa gag gac |     |     | 1676 |
| Gly Leu Gly Gly Asp His Asp Gly Leu Met Thr Leu Thr Glu Glu Asp |     |     |      |
| 310   | 315 | 320 | 325  |
| atc gca acc acc atc gag tac ctg gtg cgt ctg cac gca ggt gag cgc |     |     | 1724 |
| Ile Ala Thr Thr Ile Glu Tyr Leu Val Arg Leu His Ala Gly Glu Arg |     |     |      |
| 330   | 335 | 340 |      |
| gtc atg act tct cca aat ggt gaa gag atc cca gtc gag acc gat gac |     |     | 1772 |
| Val Met Thr Ser Pro Asn Gly Glu Ile Pro Val Glu Thr Asp Asp     |     |     |      |
| 345   | 350 | 355 |      |
| atc gac cac ttt ggt aac cgt cgt ctg acc gtt ggc gaa ctg atc     |     |     | 1820 |
| Ile Asp His Phe Gly Asn Arg Arg Leu Arg Thr Val Gly Glu Leu Ile |     |     |      |
| 360   | 365 | 370 |      |
| cag aac cag gtc cgt gtc ggc ctg tcc cgc atg gag cgc gtt gtt cgt |     |     | 1868 |
| Gln Asn Gln Val Arg Val Gly Leu Ser Arg Met Glu Arg Val Val Arg |     |     |      |
| 375   | 380 | 385 |      |
| gag cgt atg acc acc cag gat gcg gag tcc att act cct act tcc ttg |     |     | 1916 |
| Glu Arg Met Thr Thr Gln Asp Ala Glu Ser Ile Thr Pro Thr Ser Leu |     |     |      |
| 390   | 395 | 400 | 405  |
| atc aac gtt cgt cct gtc tct gca gct atc cgt gag ttc ttc gga act |     |     | 1964 |
| Ile Asn Val Arg Pro Val Ser Ala Ala Ile Arg Glu Phe Phe Gly Thr |     |     |      |
| 410   | 415 | 420 |      |
| tcc cag ctg tct cag ttc atg gtc cag aac aac tcc ctg tct ggt ttg |     |     | 2012 |
| Ser Gln Leu Ser Gln Phe Met Val Gln Asn Asn Ser Leu Ser Gly Leu |     |     |      |

| 425   | 430 | 435 |      |
|---|-----|-----|------|
| act cac aag cgt cgt ctg tcg gct ctg ggc ccg ggt ggt ctg tcc cgt<br>Thr His Lys Arg Arg Leu Ser Ala Leu Gly Pro Gly Gly Leu Ser Arg<br>440 | 445 | 450 | 2060 |
| gag cgc gcc ggc atc gag gtt cga gac gtt cac cca tct cac tac ggc<br>Glu Arg Ala Gly Ile Glu Val Arg Asp Val His Pro Ser His Tyr Gly<br>455 | 460 | 465 | 2108 |
| cgt atg tgc cca att gag act ccg gaa ggt cca aac att ggc ctg atc<br>Arg Met Cys Pro Ile Glu Thr Pro Glu Gly Pro Asn Ile Gly Leu Ile<br>470 | 475 | 480 | 2156 |
| ggt tcc ttg gct tcc tat gct cga gtg aac cca ttc ggt ttc att gag<br>Gly Ser Leu Ala Ser Tyr Ala Arg Val Asn Pro Phe Gly Phe Ile Glu<br>490 | 495 | 500 | 2204 |
| acc cca tac cgt cgc atc atc gac ggc aag ctg acc gac cag att gac<br>Thr Pro Tyr Arg Arg Ile Ile Asp Gly Lys Leu Thr Asp Gln Ile Asp<br>505 | 510 | 515 | 2252 |
| tac ctt acc gct gat gag gaa gac cgc ttc gtt gct gcg cag gca aac<br>Tyr Leu Thr Ala Asp Glu Glu Asp Arg Phe Val Val Ala Gln Ala Asn<br>520 | 525 | 530 | 2300 |
| acg cac tac gac gaa gag ggc aac atc acc gat gag acc gtc act gtt<br>Thr His Tyr Asp Glu Glu Gly Asn Ile Thr Asp Glu Thr Val Thr Val<br>535 | 540 | 545 | 2348 |
| cgt ctg aag gac ggc gac atc gcc atg gtt ggc cgc aac gct gtt gat<br>Arg Leu Lys Asp Gly Asp Ile Ala Met Val Gly Arg Asn Ala Val Asp<br>550 | 555 | 560 | 2396 |
| tac atg gac gtt tcc cct cgt cag atg gtt tct gtt ggt acc gct atg<br>Tyr Met Asp Val Ser Pro Arg Gln Met Val Ser Val Gly Thr Ala Met<br>570 | 575 | 580 | 2444 |
| att cca ttc ctg gag cac gac gat gct aac cgt gca ctg atg ggc gct<br>Ile Pro Phe Leu Glu His Asp Asp Ala Asn Arg Ala Leu Met Gly Ala<br>585 | 590 | 595 | 2492 |
| aac atg cag aag cag gct gtg cca ctg att cgt gcc gag gct cct ttc<br>Asn Met Gln Lys Gln Ala Val Pro Leu Ile Arg Ala Glu Ala Pro Phe<br>600 | 605 | 610 | 2540 |
| gtg ggc acc ggt atg gag cag cgc gca gca tac gac gcc ggc gac ctg<br>Val Gly Thr Gly Met Glu Gln Arg Ala Ala Tyr Asp Ala Gly Asp Leu<br>615 | 620 | 625 | 2588 |
| gtt att acc cca gtc gca ggt gtg gtg gaa aac gtt tca gct gac ttc<br>Val Ile Thr Pro Val Ala Gly Val Val Glu Asn Val Ser Ala Asp Phe<br>630 | 635 | 640 | 2636 |
| atc acc atc atg gct gat gac ggc aag cgc gaa acc tac ctg ctg cgt<br>Ile Thr Ile Met Ala Asp Asp Gly Lys Arg Glu Thr Tyr Leu Leu Arg<br>650 | 655 | 660 | 2684 |

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| aag ttc cag cgc acc aac cag ggc acc agc tac aac cag aag cct ttg<br>Lys Phe Gln Arg Thr Asn Gln Gly Thr Ser Tyr Asn Gln Lys Pro Leu<br>665 670 675     | 2732 |
| gtt aac ttg ggc gag cgc gtt gaa gct ggc cag gtt att gct gat ggt<br>Val Asn Leu Gly Glu Arg Val Glu Ala Gly Gln Val Ile Ala Asp Gly<br>680 685 690     | 2780 |
| cca ggt acc ttc aat ggt gaa atg tcc ctt ggc cgt aac ctt ctg gtt<br>Pro Gly Thr Phe Asn Gly Glu Met Ser Leu Gly Arg Asn Leu Leu Val<br>695 700 705     | 2828 |
| gcg ttc atg cct tgg gaa ggc cac aac tac gag gat gcg atc atc ctc<br>Ala Phe Met Pro Trp Glu Gly His Asn Tyr Glu Asp Ala Ile Ile Leu<br>710 715 720 725 | 2876 |
| aac cag aac atc gtt gag cag gac atc ttg acc tcg atc cac atc gag<br>Asn Gln Asn Ile Val Glu Gln Asp Ile Leu Thr Ser Ile His Ile Glu<br>730 735 740     | 2924 |
| gag cac gag atc gat gcc cgc gac act aag ctt ggc gcc gaa gaa atc<br>Glu His Glu Ile Asp Ala Arg Asp Thr Lys Leu Gly Ala Glu Glu Ile<br>745 750 755     | 2972 |
| acc cgc gac atc cct aat gtg tct gaa gaa gtc ctc aag gac ctc gac<br>Thr Arg Asp Ile Pro Asn Val Ser Glu Glu Val Leu Lys Asp Leu Asp<br>760 765 770     | 3020 |
| gac cgc ggt att gtc cgc atc ggt gct gat gtt cgt gac ggc gac atc<br>Asp Arg Gly Ile Val Arg Ile Gly Ala Asp Val Arg Asp Gly Asp Ile<br>775 780 785     | 3068 |
| ctg gtc ggt aag gtc acc cct aag ggc gag acc gag ctc acc ccg gaa<br>Leu Val Gly Lys Val Thr Pro Lys Gly Glu Thr Glu Leu Thr Pro Glu<br>790 795 800 805 | 3116 |
| gag cgc ttg ctg cgc gca atc ttc ggt gag aag gcc cgc gaa gtt cgc<br>Glu Arg Leu Leu Arg Ala Ile Phe Gly Glu Lys Ala Arg Glu Val Arg<br>810 815 820     | 3164 |
| gat acc tcc atg aag gtg cct cac ggt gag acc ggc aag gtc atc ggc<br>Asp Thr Ser Met Lys Val Pro His Gly Glu Thr Gly Lys Val Ile Gly<br>825 830 835     | 3212 |
| gtg cgt cac ttc tcc cgc gag gac gac gat ctg gct cct ggc gtc<br>Val Arg His Phe Ser Arg Glu Asp Asp Asp Asp Leu Ala Pro Gly Val<br>840 845 850         | 3260 |
| aac gag atg atc cgt atc tac gtt gct cag aag cgt aag atc cag gac<br>Asn Glu Met Ile Arg Ile Tyr Val Ala Gln Lys Arg Lys Ile Gln Asp<br>855 860 865     | 3308 |
| ggc gat aag ctc gct ggc cgc cac ggt aac aag ggt gtt gtc ggt aaa<br>Gly Asp Lys Leu Ala Gly Arg His Gly Asn Lys Gly Val Val Gly Lys<br>870 875 880 885 | 3356 |

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| att ttg cct cag gaa gat atg cca ttc ctt cca gac ggc act cct gtt<br>Ile Leu Pro Gln Glu Asp Met Pro Phe Leu Pro Asp Gly Thr Pro Val<br>890 895 900     | 3404 |
| gac atc atc ttg aac acc cac ggt gtt cca cgt cgt atg aac att ggt<br>Asp Ile Ile Leu Asn Thr His Gly Val Pro Arg Arg Met Asn Ile Gly<br>905 910 915     | 3452 |
| cag gtt ctt gag acc cac ctt ggc tgg ctg gca tct gct ggt tgg tcc<br>Gln Val Leu Glu Thr His Leu Gly Trp Leu Ala Ser Ala Gly Trp Ser<br>920 925 930     | 3500 |
| gtg gat cct gaa gat cct gag aac gct gag ctc gtc aag act ctg cct<br>Val Asp Pro Glu Asp Pro Glu Asn Ala Glu Leu Val Lys Thr Leu Pro<br>935 940 945     | 3548 |
| gca gac ctc ctc gag gtt cct gct ggt tcc ttg act gca act cct gtg<br>Ala Asp Leu Leu Glu Val Pro Ala Gly Ser Leu Thr Ala Thr Pro Val<br>950 955 960 965 | 3596 |
| ttc gac ggt gcg tca aac gaa gag ctc gca ggc ctg ctc gct aat tca<br>Phe Asp Gly Ala Ser Asn Glu Glu Leu Ala Gly Leu Leu Ala Asn Ser<br>970 975 980     | 3644 |
| cgt cca aac cgc gac ggc gac gtc atg aac gcg gat ggt aaa gca<br>Arg Pro Asn Arg Asp Gly Asp Val Met Val Asn Ala Asp Gly Lys Ala<br>985 990 995         | 3692 |
| acg ctt atc gac ggt cgc tcc ggt gag cct tac ccg tac ccg gtt<br>Thr Leu Ile Asp Gly Arg Ser Gly Glu Pro Tyr Pro Tyr Pro Val<br>1000 1005 1010          | 3737 |
| tcc atc ggc tac atg tac atg ctg aag ctg cac cac ctc gtt gac<br>Ser Ile Gly Tyr Met Tyr Met Leu Lys Leu His His Leu Val Asp<br>1015 1020 1025          | 3782 |
| gag aag atc cac gca cgt tcc act ggt cct tac tcc atg att acc<br>Glu Lys Ile His Ala Arg Ser Thr Gly Pro Tyr Ser Met Ile Thr<br>1030 1035 1040          | 3827 |
| cag cag cca ctg ggt ggt aaa gca cag ttc ggt gga cag cgt ttc<br>Gln Gln Pro Leu Gly Gly Lys Ala Gln Phe Gly Gly Gln Arg Phe<br>1045 1050 1055          | 3872 |
| ggc gaa atg gag gtg tgg gca atg cag gca tac ggc gct gcc tac<br>Gly Glu Met Glu Val Trp Ala Met Gln Ala Tyr Gly Ala Ala Tyr<br>1060 1065 1070          | 3917 |
| aca ctt cag gag ctg ctg acc atc aag tct gat gac gtg gtt ggc<br>Thr Leu Gln Glu Leu Leu Thr Ile Lys Ser Asp Asp Val Val Gly<br>1075 1080 1085          | 3962 |
| cgt gtc aag gtc tac gaa gca att gtg aag ggc gag aac atc ccg<br>Arg Val Lys Val Tyr Glu Ala Ile Val Lys Gly Glu Asn Ile Pro<br>1090 1095 1100          | 4007 |
| gat cca ggt att cct gag tcc ttc aag gtt ctc ctc aag gag ctc   | 4052 |

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| Asp Pro Gly Ile Pro Glu Ser Phe Lys Val Leu Leu Lys Glu Leu           |      |
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| cag tcc ttg tgc ctg aac gtg gag gtt ctc tcc gca gac ggc act           | 4097 |
| Gln Ser Leu Cys Leu Asn Val Glu Val Leu Ser Ala Asp Gly Thr           |      |
| 1120 1125 1130  |      |
| cca atg gag ctc gcg ggt gac gac gac gac ttc gat cag gca ggc           | 4142 |
| Pro Met Glu Leu Ala Gly Asp Asp Asp Asp Phe Asp Gln Ala Gly           |      |
| 1135 1140 1145  |      |
| gcc tca ctt ggc atc aac ctg tcc cgt gac gag cgt tcc gac gcc           | 4187 |
| Ala Ser Leu Gly Ile Asn Leu Ser Arg Asp Glu Arg Ser Asp Ala           |      |
| 1150 1155 1160  |      |
| gac acc gca tagcagatca gaaaacaacc gctagaaaatc aagccataca              | 4236 |
| Asp Thr Ala   |      |
| 1165  |      |
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| cgtcttcgat gagctccgca tcggcctggc caccgcccac gacatccgccc gttggtccaa    | 4356 |
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| ccagaacttc gaccttgcgtatgc   | 5099 |
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| <213> Corynebacterium glutamicum                                      |      |
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Ala Pro Ile Glu Val Pro Gly Leu Leu Asp Leu Gln Leu Asp Ser Tyr  
35 40 45

Ser Trp Leu Ile Gly Thr Pro Glu Trp Arg Ala Arg Gln Lys Glu Glu  
50 55 60

Phe Gly Glu Gly Ala Arg Val Thr Ser Gly Leu Glu Asn Ile Leu Glu  
65 70 75 80

Glu Leu Ser Pro Ile Gln Asp Tyr Ser Gly Asn Met Ser Leu Ser Leu  
85 90 95

Ser Glu Pro Arg Phe Glu Asp Val Lys Asn Thr Ile Asp Glu Ala Lys  
100 105 110

Glu Lys Asp Ile Asn Tyr Ala Ala Pro Leu Tyr Val Thr Ala Glu Phe  
115 120 125

Val Asn Asn Thr Thr Gly Glu Ile Lys Ser Gln Thr Val Phe Ile Gly  
130 135 140

Asp Phe Pro Met Met Thr Asp Lys Gly Thr Phe Ile Ile Asn Gly Thr  
145 150 155 160

Glu Arg Val Val Val Ser Gln Leu Val Arg Ser Pro Gly Val Tyr Phe  
165 170 175

Asp Gln Thr Ile Asp Lys Ser Thr Glu Arg Pro Leu His Ala Val Lys  
180 185 190

Val Ile Pro Phe Arg Gly Ala Trp Leu Glu Phe Asp Val Asp Lys Arg  
195 200 205

Asp Ser Val Gly Val Arg Ile Asp Arg Lys Arg Arg Gln Pro Val Thr  
210 215 220

Val Leu Leu Lys Ala Leu Gly Trp Thr Thr Glu Gln Ile Thr Glu Arg

225

230

235

240

Phe Gly Phe Ser Glu Ile Met Met Ser Thr Leu Glu Ser Asp Gly Val  
245 250 255

Ala Asn Thr Asp Glu Ala Leu Leu Glu Ile Tyr Arg Lys Gln Arg Pro  
260 265 270

Gly Glu Gln Pro Thr Arg Asp Leu Ala Gln Ser Leu Leu Asp Asn Ser  
275 280 285

Phe Phe Arg Ala Lys Arg Tyr Asp Leu Ala Arg Val Gly Arg Tyr Lys  
290 295 300

Ile Asn Arg Lys Leu Gly Leu Gly Asp His Asp Gly Leu Met Thr  
305 310 315 320

Leu Thr Glu Glu Asp Ile Ala Thr Thr Ile Glu Tyr Leu Val Arg Leu  
325 330 335

His Ala Gly Glu Arg Val Met Thr Ser Pro Asn Gly Glu Glu Ile Pro  
340 345 350

Val Glu Thr Asp Asp Ile Asp His Phe Gly Asn Arg Arg Leu Arg Thr  
355 360 365

Val Gly Glu Leu Ile Gln Asn Gln Val Arg Val Gly Leu Ser Arg Met  
370 375 380

Glu Arg Val Val Arg Glu Arg Met Thr Thr Gln Asp Ala Glu Ser Ile  
385 390 395 400

Thr Pro Thr Ser Leu Ile Asn Val Arg Pro Val Ser Ala Ala Ile Arg  
405 410 415

Glu Phe Phe Gly Thr Ser Gln Leu Ser Gln Phe Met Val Gln Asn Asn  
420 425 430

Ser Leu Ser Gly Leu Thr His Lys Arg Arg Leu Ser Ala Leu Gly Pro  
435 440 445

Gly Gly Leu Ser Arg Glu Arg Ala Gly Ile Glu Val Arg Asp Val His  
450 455 460

Pro Ser His Tyr Gly Arg Met Cys Pro Ile Glu Thr Pro Glu Gly Pro  
465 470 475 480

Asn Ile Gly Leu Ile Gly Ser Leu Ala Ser Tyr Ala Arg Val Asn Pro  
485 490 495

Phe Gly Phe Ile Glu Thr Pro Tyr Arg Arg Ile Ile Asp Gly Lys Leu  
500 505 510

Thr Asp Gln Ile Asp Tyr Leu Thr Ala Asp Glu Glu Asp Arg Phe Val  
515 520 525

Val Ala Gln Ala Asn Thr His Tyr Asp Glu Glu Gly Asn Ile Thr Asp  
530 535 540

Glu Thr Val Thr Val Arg Leu Lys Asp Gly Asp Ile Ala Met Val Gly  
545 550 555 560

Arg Asn Ala Val Asp Tyr Met Asp Val Ser Pro Arg Gln Met Val Ser  
565 570 575

Val Gly Thr Ala Met Ile Pro Phe Leu Glu His Asp Asp Ala Asn Arg  
580 585 590

Ala Leu Met Gly Ala Asn Met Gln Lys Gln Ala Val Pro Leu Ile Arg  
595 600 605

Ala Glu Ala Pro Phe Val Gly Thr Gly Met Glu Gln Arg Ala Ala Tyr  
610 615 620

Asp Ala Gly Asp Leu Val Ile Thr Pro Val Ala Gly Val Val Glu Asn  
625 630 635 640

Val Ser Ala Asp Phe Ile Thr Ile Met Ala Asp Asp Gly Lys Arg Glu  
645 650 655

Thr Tyr Leu Leu Arg Lys Phe Gln Arg Thr Asn Gln Gly Thr Ser Tyr  
660 665 670

Asn Gln Lys Pro Leu Val Asn Leu Gly Glu Arg Val Glu Ala Gly Gln  
675 680 685

Val Ile Ala Asp Gly Pro Gly Thr Phe Asn Gly Glu Met Ser Leu Gly  
690 695 700

Arg Asn Leu Leu Val Ala Phe Met Pro Trp Glu Gly His Asn Tyr Glu  
705 710 715 720

Asp Ala Ile Ile Leu Asn Gln Asn Ile Val Glu Gln Asp Ile Leu Thr  
725 730 735

Ser Ile His Ile Glu Glu His Glu Ile Asp Ala Arg Asp Thr Lys Leu  
740 745 750

Gly Ala Glu Glu Ile Thr Arg Asp Ile Pro Asn Val Ser Glu Glu Val  
755 760 765

Leu Lys Asp Leu Asp Asp Arg Gly Ile Val Arg Ile Gly Ala Asp Val  
770 775 780

Arg Asp Gly Asp Ile Leu Val Gly Lys Val Thr Pro Lys Gly Glu Thr  
785 790 795 800

Glu Leu Thr Pro Glu Glu Arg Leu Leu Arg Ala Ile Phe Gly Glu Lys  
805 810 815

Ala Arg Glu Val Arg Asp Thr Ser Met Lys Val Pro His Gly Glu Thr  
820 825 830

Gly Lys Val Ile Gly Val Arg His Phe Ser Arg Glu Asp Asp Asp Asp  
835 840 845

Leu Ala Pro Gly Val Asn Glu Met Ile Arg Ile Tyr Val Ala Gln Lys  
850 855 860

Arg Lys Ile Gln Asp Gly Asp Lys Leu Ala Gly Arg His Gly Asn Lys  
865 870 875 880

Gly Val Val Gly Lys Ile Leu Pro Gln Glu Asp Met Pro Phe Leu Pro  
885 890 895

Asp Gly Thr Pro Val Asp Ile Ile Leu Asn Thr His Gly Val Pro Arg  
900 905 910

Arg Met Asn Ile Gly Gln Val Leu Glu Thr His Leu Gly Trp Leu Ala  
915 920 925

Ser Ala Gly Trp Ser Val Asp Pro Glu Asp Pro Glu Asn Ala Glu Leu  
930 935 940

Val Lys Thr Leu Pro Ala Asp Leu Leu Glu Val Pro Ala Gly Ser Leu  
945 950 955 960

Thr Ala Thr Pro Val Phe Asp Gly Ala Ser Asn Glu Glu Leu Ala Gly  
965 970 975

Leu Leu Ala Asn Ser Arg Pro Asn Arg Asp Gly Asp Val Met Val Asn  
980 985 990

Ala Asp Gly Lys Ala Thr Leu Ile Asp Gly Arg Ser Gly Glu Pro Tyr  
995 1000 1005

Pro Tyr Pro Val Ser Ile Gly Tyr Met Tyr Met Leu Lys Leu His  
1010 1015 1020

His Leu Val Asp Glu Lys Ile His Ala Arg Ser Thr Gly Pro Tyr  
1025 1030 1035

Ser Met Ile Thr Gln Gln Pro Leu Gly Gly Lys Ala Gln Phe Gly  
1040 1045 1050

Gly Gln Arg Phe Gly Glu Met Glu Val Trp Ala Met Gln Ala Tyr  
1055 1060 1065

Gly Ala Ala Tyr Thr Leu Gln Glu Leu Leu Thr Ile Lys Ser Asp  
1070 1075 1080

Asp Val Val Gly Arg Val Lys Val Tyr Glu Ala Ile Val Lys Gly  
1085 1090 1095

Glu Asn Ile Pro Asp Pro Gly Ile Pro Glu Ser Phe Lys Val Leu  
1100 1105 1110

Leu Lys Glu Leu Gln Ser Leu Cys Leu Asn Val Glu Val Leu Ser  
1115 1120 1125

Ala Asp Gly Thr Pro Met Glu Leu Ala Gly Asp Asp Asp Asp Phe

1130

1135

1140

Asp Gln Ala Gly Ala Ser Leu Gly Ile Asn Leu Ser Arg Asp Glu  
1145 1150 1155

Arg Ser Asp Ala Asp Thr Ala  
1160 1165

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<222> (2016)..(2016)  
<223> Substitution of cytosine by thymine

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tcgacgcctc cctcgacgat gcagctgtct ctaagctggt tgcacaggcc gaaagcatcc 180  
ctgatggaga tgtgagcaaa atcgaaaata cctgttaggtat tgtgatcggt gcggatttgg 240  
ctctcgtggg cctggccggg tgaaaaatcc cgtttggggaa gaaacgtcga gaagcttaac 300  
ctgctgttca aatagatttt ccctgtttcg aattgcggaa accccgggtt tgaaaatgttt 360  
ggtgccctcgta agaagggttc aagaagattt ctgggaaacg cggccgtcg gttgggtgtc 420  
aatagcacgc ggagcaccag atgaaaaatc tcccccttac tttcgccgc gattggata 480  
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cttaatggcc ttgaccagcc aggtgcaatt acccgctgtga g gtg ctg gaa gga ccc 716  
Val Leu Glu Gly Pro  
1 5

atc ttg gca gtc tcc cgc cag acc aag tca gtc gtc gat att ccc ggt 764  
Ile Leu Ala Val Ser Arg Gln Thr Lys Ser Val Val Asp Ile Pro Gly

| 10  | 15  | 20  |      |
|---|-----|-----|------|
| gca ccg cag cgt tat tct ttc gcg aag gtg tcc gca ccc att gag gtg<br>Ala Pro Gln Arg Tyr Ser Phe Ala Lys Val Ser Ala Pro Ile Glu Val<br>25  | 30  | 35  | 812  |
| ccc ggg cta cta gat ctt caa ctg gat tct tac tcc tgg ctg att ggt<br>Pro Gly Leu Leu Asp Leu Gln Leu Asp Ser Tyr Ser Trp Leu Ile Gly<br>40  | 45  | 50  | 860  |
| acg cct gag tgg cgt gct cgt cag aag gaa gaa ttc ggc gag gga gcc<br>Thr Pro Glu Trp Arg Ala Arg Gln Lys Glu Glu Phe Gly Glu Gly Ala<br>55  | 60  | 65  | 908  |
| cgc gta acc agc ggc ctt gag aac att ctc gag gag ctc tcc cca atc<br>Arg Val Thr Ser Gly Leu Glu Asn Ile Leu Glu Leu Ser Pro Ile<br>70      | 75  | 80  | 956  |
| cag gat tac tct gga aac atg tcc ctg agc ctt tcg gag cca cgc ttc<br>Gln Asp Tyr Ser Gly Asn Met Ser Leu Ser Leu Ser Glu Pro Arg Phe<br>90  | 95  | 100 | 1004 |
| gaa gac gtc aag aac acc att gac gag gcg aaa gaa aag gac atc aac<br>Glu Asp Val Lys Asn Thr Ile Asp Glu Ala Lys Glu Lys Asp Ile Asn<br>105 | 110 | 115 | 1052 |
| tac gcg gcg cca ctg tat gtg acc gcg gag ttc gtc aac aac acc acc<br>Tyr Ala Ala Pro Leu Tyr Val Thr Ala Glu Phe Val Asn Asn Thr Thr<br>120 | 125 | 130 | 1100 |
| ggt gaa atc aag tct cag act gtc ttc atc ggc gat ttc cca atg atg<br>Gly Glu Ile Lys Ser Gln Thr Val Phe Ile Gly Asp Phe Pro Met Met<br>135 | 140 | 145 | 1148 |
| acg gac aag gga acg ttc atc atc aac gga acc gaa cgc gtt gtg gtc<br>Thr Asp Lys Gly Thr Phe Ile Ile Asn Gly Thr Glu Arg Val Val Val<br>150 | 155 | 160 | 1196 |
| agc cag ctc gtc cgc tcc ccg ggc gtg tac ttt gac cag acc atc gat<br>Ser Gln Leu Val Arg Ser Pro Gly Val Tyr Phe Asp Gln Thr Ile Asp<br>170 | 175 | 180 | 1244 |
| aag tca act gag cgt cca ctg cac gcc gtg aag gtt att cct tcc cgt<br>Lys Ser Thr Glu Arg Pro Leu His Ala Val Lys Val Ile Pro Ser Arg<br>185 | 190 | 195 | 1292 |
| ggt gct tgg ctt gag ttt gac gtc gat aag cgc gat tcg gtt ggt gtt<br>Gly Ala Trp Leu Glu Phe Asp Val Asp Lys Arg Asp Ser Val Gly Val<br>200 | 205 | 210 | 1340 |
| cgt att gac cgc aag cgt cgc cag cca gtc acc gta ctg ctg aag gct<br>Arg Ile Asp Arg Lys Arg Arg Gln Pro Val Thr Val Leu Leu Lys Ala<br>215 | 220 | 225 | 1388 |
| ctt ggc tgg acc act gag cag atc acc gag cgt ttc ggt ttc tct gaa<br>Leu Gly Trp Thr Thr Glu Gln Ile Thr Glu Arg Phe Phe Ser Glu<br>230     | 235 | 240 | 1436 |
|   |     |     | 245  |

|   |      |
|---|------|
| atc atg atg tcc acc ctc gag tcc gat ggt gta gca aac acc gat gag<br>Ile Met Met Ser Thr Leu Glu Ser Asp Gly Val Ala Asn Thr Asp Glu<br>250 255 260     | 1484 |
| gca ttg ctg gag atc tac cgc aag cag cgt cca ggc gag cag cct acc<br>Ala Leu Leu Glu Ile Tyr Arg Lys Gln Arg Pro Gly Gln Pro Thr<br>265 270 275         | 1532 |
| cgc gac ctt gcg cag tcc ctc ctg gac aac agc ttc ttc cgt gca aag<br>Arg Asp Leu Ala Gln Ser Leu Leu Asp Asn Ser Phe Phe Arg Ala Lys<br>280 285 290     | 1580 |
| cgc tac gac ctg gct cgc gtt ggt cgt tac aag atc aac cgc aag ctc<br>Arg Tyr Asp Leu Ala Arg Val Gly Arg Tyr Lys Ile Asn Arg Lys Leu<br>295 300 305     | 1628 |
| ggc ctt ggt ggc gac cac gat ggt ttg atg act ctt act gaa gag gac<br>Gly Leu Gly Asp His Asp Gly Leu Met Thr Leu Thr Glu Glu Asp<br>310 315 320 325     | 1676 |
| atc gca acc acc atc gag tac ctg gtg cgt ctg cac gca ggt gag cgc<br>Ile Ala Thr Thr Ile Glu Tyr Leu Val Arg Leu His Ala Gly Glu Arg<br>330 335 340     | 1724 |
| gtc atg act tct cca aat ggt gaa gag atc cca gtc gag acc gat gac<br>Val Met Thr Ser Pro Asn Gly Glu Ile Pro Val Glu Thr Asp Asp<br>345 350 355         | 1772 |
| atc gac cac ttt ggt aac cgt cgt ctg cgt acc gtt ggc gaa ctg atc<br>Ile Asp His Phe Gly Asn Arg Arg Leu Arg Thr Val Gly Glu Leu Ile<br>360 365 370     | 1820 |
| cag aac cag gtc cgt gtc ggc ctg tcc cgc atg gag cgc gtt gtt cgt<br>Gln Asn Gln Val Arg Val Gly Leu Ser Arg Met Glu Arg Val Val Arg<br>375 380 385     | 1868 |
| gag cgt atg acc acc cag gat gcg gag tcc att act cct act tcc ttg<br>Glu Arg Met Thr Thr Gln Asp Ala Glu Ser Ile Thr Pro Thr Ser Leu<br>390 395 400 405 | 1916 |
| atc aac gtt cgt cct gtc tct gca gct atc cgt gag ttc ttc gga act<br>Ile Asn Val Arg Pro Val Ser Ala Ala Ile Arg Glu Phe Phe Gly Thr<br>410 415 420     | 1964 |
| tcc cag ctg tct cag ttc atg gac cag aac tcc ctg tct ggt ttg<br>Ser Gln Leu Ser Gln Phe Met Asp Gln Asn Ser Leu Ser Gly Leu<br>425 430 435             | 2012 |
| act tac aag cgt cgt ctg tcg gct ctg ggc ccg ggt ggt ctg tcc cgt<br>Thr Tyr Lys Arg Arg Leu Ser Ala Leu Gly Pro Gly Gly Leu Ser Arg<br>440 445 450     | 2060 |
| gag cgc gcc ggc atc gag gtt cga gac gtt cac cca tct cac tac ggc<br>Glu Arg Ala Gly Ile Glu Val Arg Asp Val His Pro Ser His Tyr Gly<br>455 460 465     | 2108 |

|   |      |
|---|------|
| cgt atg tgc cca att gag act ccg gaa ggt cca aac att ggc ctg atc<br>Arg Met Cys Pro Ile Glu Thr Pro Glu Gly Pro Asn Ile Gly Leu Ile<br>470 475 480 485 | 2156 |
| ggt tcc ttg gct tcc tat gct cga gtg aac cca ttc ggt ttc att gag<br>Gly Ser Leu Ala Ser Tyr Ala Arg Val Asn Pro Phe Gly Phe Ile Glu<br>490 495 500     | 2204 |
| acc cca tac cgt cgc atc atc gac ggc aag ctg acc gac cag att gac<br>Thr Pro Tyr Arg Arg Ile Ile Asp Gly Lys Leu Thr Asp Gln Ile Asp<br>505 510 515     | 2252 |
| tac ctt acc gct gat gag gaa gac cgc ttc gtt gtt gcg cag gca aac<br>Tyr Leu Thr Ala Asp Glu Glu Asp Arg Phe Val Val Ala Gln Ala Asn<br>520 525 530     | 2300 |
| acg cac tac gac gaa gag ggc aac atc acc gat gag acc gtc act gtt<br>Thr His Tyr Asp Glu Glu Asn Ile Thr Asp Glu Thr Val Thr Val<br>535 540 545         | 2348 |
| cgt ctg aag gac ggc gac atc gcc atg gtt ggc cgc aac gcg gtt gat<br>Arg Leu Lys Asp Gly Asp Ile Ala Met Val Gly Arg Asn Ala Val Asp<br>550 555 560 565 | 2396 |
| tac atg gac gtt tcc cct cgt cag atg gtt tct gtt ggt acc gcg atg<br>Tyr Met Asp Val Ser Pro Arg Gln Met Val Ser Val Gly Thr Ala Met<br>570 575 580     | 2444 |
| att cca ttc ctg gag cac gac gat gct aac cgt gca ctg atg ggc gcg<br>Ile Pro Phe Leu Glu His Asp Asp Ala Asn Arg Ala Leu Met Gly Ala<br>585 590 595     | 2492 |
| aac atg cag aag cag gct gtg cca ctg att cgt gcc gag gct cct ttc<br>Asn Met Gln Lys Gln Ala Val Pro Leu Ile Arg Ala Glu Ala Pro Phe<br>600 605 610     | 2540 |
| gtg ggc acc ggt atg gag cag cgc gca gca tac gac gcc ggc gac ctg<br>Val Gly Thr Gly Met Glu Gln Arg Ala Ala Tyr Asp Ala Gly Asp Leu<br>615 620 625     | 2588 |
| gtt att acc cca gtc gca ggt gtg gtg gaa aac gtt tca gct gac ttc<br>Val Ile Thr Pro Val Ala Gly Val Val Glu Asn Val Ser Ala Asp Phe<br>630 635 640 645 | 2636 |
| atc acc atc atg gct gat gac ggc aag cgc gaa acc tac ctg ctg cgt<br>Ile Thr Ile Met Ala Asp Asp Gly Lys Arg Glu Thr Tyr Leu Leu Arg<br>650 655 660     | 2684 |
| aag ttc cag cgc acc aac cag ggc acc agc tac aac cag aag cct ttg<br>Lys Phe Gln Arg Thr Asn Gln Gly Thr Ser Tyr Asn Gln Lys Pro Leu<br>665 670 675     | 2732 |
| gtt aac ttg ggc gag cgc gtt gaa gct ggc cag gtt att gct gat ggt<br>Val Asn Leu Gly Glu Arg Val Glu Ala Gly Gln Val Ile Ala Asp Gly<br>680 685 690     | 2780 |
| cca ggt acc ttc aat ggt gaa atg tcc ctt ggc cgt aac ctt ctg gtt   | 2828 |

|   |     |     |      |  |
|---|-----|-----|------|--|
| Pro Gly Thr Phe Asn Gly Glu Met Ser Leu Gly Arg Asn Leu Leu Val |     |     |      |  |
| 695   | 700 | 705 |      |  |
| gct ttc atg cct tgg gaa ggc cac aac tac gag gat gct atc atc ctc |     |     | 2876 |  |
| Ala Phe Met Pro Trp Glu Gly His Asn Tyr Glu Asp Ala Ile Ile Leu |     |     |      |  |
| 710   | 715 | 720 | 725  |  |
| aac cag aac atc gtt gag cag gac atc ttg acc tcg atc cac atc gag |     |     | 2924 |  |
| Asn Gln Asn Ile Val Glu Gln Asp Ile Leu Thr Ser Ile His Ile Glu |     |     |      |  |
| 730   | 735 | 740 |      |  |
| gag cac gag atc gat gcc cgc gac act aag ctt ggc gcc gaa gaa atc |     |     | 2972 |  |
| Glu His Glu Ile Asp Ala Arg Asp Thr Lys Leu Gly Ala Glu Glu Ile |     |     |      |  |
| 745   | 750 | 755 |      |  |
| acc cgc gac atc cct aat gtg tct gaa gaa gtc ctc aag gac ctc gac |     |     | 3020 |  |
| Thr Arg Asp Ile Pro Asn Val Ser Glu Glu Val Leu Lys Asp Leu Asp |     |     |      |  |
| 760   | 765 | 770 |      |  |
| gac cgc ggt att gtc cgc atc ggt gct gat gtt cgt gac ggc gac atc |     |     | 3068 |  |
| Asp Arg Gly Ile Val Arg Ile Gly Ala Asp Val Arg Asp Gly Asp Ile |     |     |      |  |
| 775   | 780 | 785 |      |  |
| ctg gtc ggt aag gtc acc cct aag ggc gag acc gag ctc acc ccg gaa |     |     | 3116 |  |
| Leu Val Gly Lys Val Thr Pro Lys Gly Glu Thr Glu Leu Thr Pro Glu |     |     |      |  |
| 790   | 795 | 800 | 805  |  |
| gag cgc ttg ctg cgc gca atc ttc ggt gag aag gcc cgc gaa gtt cgc |     |     | 3164 |  |
| Glu Arg Leu Leu Arg Ala Ile Phe Gly Glu Lys Ala Arg Glu Val Arg |     |     |      |  |
| 810   | 815 | 820 |      |  |
| gat acc tcc atg aag gtg cct cac ggt gag acc ggc aag gtc atc ggc |     |     | 3212 |  |
| Asp Thr Ser Met Lys Val Pro His Gly Glu Thr Gly Lys Val Ile Gly |     |     |      |  |
| 825   | 830 | 835 |      |  |
| gtg cgt cac ttc tcc cgc gag gac gac gat ctg gct cct ggc gtc     |     |     | 3260 |  |
| Val Arg His Phe Ser Arg Glu Asp Asp Asp Asp Leu Ala Pro Gly Val |     |     |      |  |
| 840   | 845 | 850 |      |  |
| aac gag atg atc cgt atc tac gtt gct cag aag cgt aag atc cag gac |     |     | 3308 |  |
| Asn Glu Met Ile Arg Ile Tyr Val Ala Gln Lys Arg Lys Ile Gln Asp |     |     |      |  |
| 855   | 860 | 865 |      |  |
| ggc gat aag ctc gct ggc cgc cac ggt aac aag ggt gtt gtc ggt aaa |     |     | 3356 |  |
| Gly Asp Lys Leu Ala Gly Arg His Gly Asn Lys Gly Val Val Gly Lys |     |     |      |  |
| 870   | 875 | 880 | 885  |  |
| att ttg cct cag gaa gat atg cca ttc ctt cca gac ggc act cct gtt |     |     | 3404 |  |
| Ile Leu Pro Gln Glu Asp Met Pro Phe Leu Pro Asp Gly Thr Pro Val |     |     |      |  |
| 890   | 895 | 900 |      |  |
| gac atc atc ttg aac acc cac ggt gtt cca cgt cgt atg aac att ggt |     |     | 3452 |  |
| Asp Ile Ile Leu Asn Thr His Gly Val Pro Arg Arg Met Asn Ile Gly |     |     |      |  |
| 905   | 910 | 915 |      |  |
| cag gtt ctt gag acc cac ctt ggc tgg ctg gca tct gct ggt tgg tcc |     |     | 3500 |  |
| Gln Val Leu Glu Thr His Leu Gly Trp Leu Ala Ser Ala Gly Trp Ser |     |     |      |  |

920

925

930

3548

gtg gat cct gaa gat cct gag aac gct gag ctc gtc aag act ctg cct  
 Val Asp Pro Glu Asp Pro Glu Asn Ala Glu Leu Val Lys Thr Leu Pro  
 935 940 945

3596

gca gac ctc ctc gag gtt cct gct ggt tcc ttg act gca act cct gtg  
 Ala Asp Leu Leu Glu Val Pro Ala Gly Ser Leu Thr Ala Thr Pro Val  
 950 955 960 965

3644

ttc gac ggt gcg tca aac gaa gag ctc gca ggc ctg ctc gct aat tca  
 Phe Asp Gly Ala Ser Asn Glu Glu Leu Ala Gly Leu Leu Ala Asn Ser  
 970 975 980

3692

cgt cca aac cgc gac ggc gac gtc atg gtt aac gcg gat ggt aaa gca  
 Arg Pro Asn Arg Asp Gly Asp Val Met Val Asn Ala Asp Gly Lys Ala  
 985 990 995

3737

acg ctt atc gac ggt cgc tcc ggt gag cct tac ccg tac ccg gtt  
 Thr Leu Ile Asp Gly Arg Ser Gly Glu Pro Tyr Pro Tyr Pro Val  
 1000 1005 1010

3782

tcc atc ggc tac atg tac atg ctg aag ctg cac cac ctc gtt gac  
 Ser Ile Gly Tyr Met Tyr Met Leu Lys Leu His His Leu Val Asp  
 1015 1020 1025

3827

gag aag atc cac gca cgt tcc act ggt cct tac tcc atg att acc  
 Glu Lys Ile His Ala Arg Ser Thr Gly Pro Tyr Ser Met Ile Thr  
 1030 1035 1040

3872

cag cag cca ctg ggt ggt aaa gca cag ttc ggt gga cag cgt ttc  
 Gln Gln Pro Leu Gly Gly Lys Ala Gln Phe Gly Gly Gln Arg Phe  
 1045 1050 1055

3917

ggc gaa atg gag gtg tgg gca atg cag gca tac ggc gct gcc tac  
 Gly Glu Met Glu Val Trp Ala Met Gln Ala Tyr Gly Ala Ala Tyr  
 1060 1065 1070

3962

aca ctt cag gag ctg ctg acc atc aag tct gat gac gtg gtt ggc  
 Thr Leu Gln Glu Leu Leu Thr Ile Lys Ser Asp Asp Val Val Gly  
 1075 1080 1085

4007

cgt gtc aag gtc tac gaa gca att gtg aag ggc gag aac atc ccg  
 Arg Val Lys Val Tyr Glu Ala Ile Val Lys Gly Glu Asn Ile Pro  
 1090 1095 1100

4052

gat cca ggt att cct gag tcc ttc aag gtt ctc ctc aag gag ctc  
 Asp Pro Gly Ile Pro Glu Ser Phe Lys Val Leu Leu Lys Glu Leu  
 1105 1110 1115

4097

cag tcc ttg tgc ctg aac gtg gag gtt ctc tcc gca gac ggc act  
 Gln Ser Leu Cys Leu Asn Val Glu Val Leu Ser Ala Asp Gly Thr  
 1120 1125 1130

4142

cca atg gag ctc gcg ggt gac gac gac gac ttc gat cag gca ggc  
 Pro Met Glu Leu Ala Gly Asp Asp Asp Asp Phe Asp Gln Ala Gly  
 1135 1140 1145

|             |                       |                       |            |      |
|-------------|-----------------------|-----------------------|------------|------|
| gcc tca ctt | ggc atc aac ctg tcc   | cgt gac gag cgt tcc   | gac gcc    | 4187 |
| Ala Ser Leu | Gly Ile Asn Leu Ser   | Arg Asp Glu Arg Ser   | Asp Ala    |      |
| 1150        | 1155                  | 1160                  |            |      |
| gac acc gca | tagcagatca gaaaacaacc | gctagaaatc aagccataca |            | 4236 |
| Asp Thr Ala |                       |                       |            |      |
| 1165        |                       |                       |            |      |
| tccccggac   | attgaagaga            | tgttctgggg            | ggaaagggag | 4296 |
| cgtttcgat   | gagctccgca            | tcggcctggc            | caccgcccac | 4356 |
| gggtgaggtc  | aagaagccgg            | agaccatcaa            | ctaccgaacc | 4416 |
| tctttctgc   | gagcgtatct            | tcggtccaac            | tcgactgg   | 4476 |
| caagcgtgtc  | cgctacaagg            | gcatcatctg            | tgaacgctgt | 4536 |
| caaggtgcgc  | cgtgagcgc             | tggacacat             | ttagctcgct | 4596 |
| gtacttcaag  | ggcgttccat            | cacgcctcg             | ctacctttg  | 4656 |
| ggacctcatc  | atctacttcg            | gtgcaacat             | catcaccagg | 4716 |
| cagcgaccag  | accactctt             | aggcagaaat            | gcttctggag | 4776 |
| cgcagagtct  | gacattgctg            | agcgtgctga            | aaagctcgaa | 4836 |
| ggcagctggc  | gctaaggccg            | acgctcgccg            | caaggttcag | 4896 |
| gcagcacatc  | cgtgagcgtg            | cacagcgcga            | aatcgatcgt | 4956 |
| cttcatcaag  | cttgcctcaa            | agcagatgat            | ccgcgatgag | 5016 |
| cgaccgctac  | gaggattact            | tcaccggtgg            | tatgggtgca | 5076 |
| ccagaacttc  | gacattgatg            | ctg                   |            | 5099 |

<210> 6  
 <211> 1165  
 <212> PRT  
 <213> ~ *Corynebacterium glutamicum*

<400> 6

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|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Val | Leu | Glu | Gly | Pro | Ile | Leu | Ala | Val | Ser | Arg | Gln | Thr | Lys | Ser | Val |
| 1   |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 15  |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Val | Asp | Ile | Pro | Gly | Ala | Pro | Gln | Arg | Tyr | Ser | Phe | Ala | Lys | Val | Ser |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 20  |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 30  |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ala | Pro | Ile | Glu | Val | Pro | Gly | Leu | Leu | Asp | Leu | Gln | Leu | Asp | Ser | Tyr |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 35  |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 45  |

Ser Trp Leu Ile Gly Thr Pro Glu Trp Arg Ala Arg Gln Lys Glu Glu  
50 55 60

Phe Gly Glu Gly Ala Arg Val Thr Ser Gly Leu Glu Asn Ile Leu Glu  
65 70 75 80

Glu Leu Ser Pro Ile Gln Asp Tyr Ser Gly Asn Met Ser Leu Ser Leu  
85 90 95

Ser Glu Pro Arg Phe Glu Asp Val Lys Asn Thr Ile Asp Glu Ala Lys  
100 105 110

Glu Lys Asp Ile Asn Tyr Ala Ala Pro Leu Tyr Val Thr Ala Glu Phe  
115 120 125

Val Asn Asn Thr Thr Gly Glu Ile Lys Ser Gln Thr Val Phe Ile Gly  
130 135 140

Asp Phe Pro Met Met Thr Asp Lys Gly Thr Phe Ile Ile Asn Gly Thr  
145 150 155 160

Glu Arg Val Val Val Ser Gln Leu Val Arg Ser Pro Gly Val Tyr Phe  
165 170 175

Asp Gln Thr Ile Asp Lys Ser Thr Glu Arg Pro Leu His Ala Val Lys  
180 185 190

Val Ile Pro Ser Arg Gly Ala Trp Leu Glu Phe Asp Val Asp Lys Arg  
195 200 205

Asp Ser Val Gly Val Arg Ile Asp Arg Lys Arg Arg Gln Pro Val Thr  
210 215 220

Val Leu Leu Lys Ala Leu Gly Trp Thr Thr Glu Gln Ile Thr Glu Arg  
225 230 235 240

Phe Gly Phe Ser Glu Ile Met Met Ser Thr Leu Glu Ser Asp Gly Val  
245 250 255

Ala Asn Thr Asp Glu Ala Leu Leu Glu Ile Tyr Arg Lys Gln Arg Pro  
260 265 270

Gly Glu Gln Pro Thr Arg Asp Leu Ala Gln Ser Leu Leu Asp Asn Ser  
275 280 285

Phe Phe Arg Ala Lys Arg Tyr Asp Leu Ala Arg Val Gly Arg Tyr Lys  
290 295 300

Ile Asn Arg Lys Leu Gly Leu Gly Gly Asp His Asp Gly Leu Met Thr  
305 310 315 320

Leu Thr Glu Glu Asp Ile Ala Thr Thr Ile Glu Tyr Leu Val Arg Leu  
325 330 335

His Ala Gly Glu Arg Val Met Thr Ser Pro Asn Gly Glu Glu Ile Pro  
340 345 350

Val Glu Thr Asp Asp Ile Asp His Phe Gly Asn Arg Arg Leu Arg Thr  
355 360 365

Val Gly Glu Leu Ile Gln Asn Gln Val Arg Val Gly Leu Ser Arg Met  
370 375 380

Glu Arg Val Val Arg Glu Arg Met Thr Thr Gln Asp Ala Glu Ser Ile  
385 390 395 400

Thr Pro Thr Ser Leu Ile Asn Val Arg Pro Val Ser Ala Ala Ile Arg  
405 410 415

Glu Phe Phe Gly Thr Ser Gln Leu Ser Gln Phe Met Asp Gln Asn Asn  
420 425 430

Ser Leu Ser Gly Leu Thr Tyr Lys Arg Arg Leu Ser Ala Leu Gly Pro  
435 440 445

Gly Gly Leu Ser Arg Glu Arg Ala Gly Ile Glu Val Arg Asp Val His  
450 455 460

Pro Ser His Tyr Gly Arg Met Cys Pro Ile Glu Thr Pro Glu Gly Pro  
465 470 475 480

Asn Ile Gly Leu Ile Gly Ser Leu Ala Ser Tyr Ala Arg Val Asn Pro  
485 490 495

Phe Gly Phe Ile Glu Thr Pro Tyr Arg Arg Ile Ile Asp Gly Lys Leu  
500 505 510

Thr Asp Gln Ile Asp Tyr Leu Thr Ala Asp Glu Glu Asp Arg Phe Val  
515 520 525

Val Ala Gln Ala Asn Thr His Tyr Asp Glu Glu Gly Asn Ile Thr Asp  
530 535 540

Glu Thr Val Thr Val Arg Leu Lys Asp Gly Asp Ile Ala Met Val Gly  
545 550 555 560

Arg Asn Ala Val Asp Tyr Met Asp Val Ser Pro Arg Gln Met Val Ser  
565 570 575

Val Gly Thr Ala Met Ile Pro Phe Leu Glu His Asp Asp Ala Asn Arg  
580 585 590

Ala Leu Met Gly Ala Asn Met Gln Lys Gln Ala Val Pro Leu Ile Arg  
595 600 605

Ala Glu Ala Pro Phe Val Gly Thr Gly Met Glu Gln Arg Ala Ala Tyr  
610 615 620

Asp Ala Gly Asp Leu Val Ile Thr Pro Val Ala Gly Val Val Glu Asn  
625 630 635 640

Val Ser Ala Asp Phe Ile Thr Ile Met Ala Asp Asp Gly Lys Arg Glu  
645 650 655

Thr Tyr Leu Leu Arg Lys Phe Gln Arg Thr Asn Gln Gly Thr Ser Tyr  
660 665 670

Asn Gln Lys Pro Leu Val Asn Leu Gly Glu Arg Val Glu Ala Gly Gln  
675 680 685

Val Ile Ala Asp Gly Pro Gly Thr Phe Asn Gly Glu Met Ser Leu Gly  
690 695 700

Arg Asn Leu Leu Val Ala Phe Met Pro Trp Glu Gly His Asn Tyr Glu  
705 710 715 720

Asp Ala Ile Ile Leu Asn Gln Asn Ile Val Glu Gln Asp Ile Leu Thr

725

730

735

Ser Ile His Ile Glu Glu His Glu Ile Asp Ala Arg Asp Thr Lys Leu  
740 745 750

Gly Ala Glu Glu Ile Thr Arg Asp Ile Pro Asn Val Ser Glu Glu Val  
755 760 765

Leu Lys Asp Leu Asp Asp Arg Gly Ile Val Arg Ile Gly Ala Asp Val  
770 775 780

Arg Asp Gly Asp Ile Leu Val Gly Lys Val Thr Pro Lys Gly Glu Thr  
785 790 795 800

Glu Leu Thr Pro Glu Glu Arg Leu Leu Arg Ala Ile Phe Gly Glu Lys  
805 810 815

Ala Arg Glu Val Arg Asp Thr Ser Met Lys Val Pro His Gly Glu Thr  
820 825 830

Gly Lys Val Ile Gly Val Arg His Phe Ser Arg Glu Asp Asp Asp Asp  
835 840 845

Leu Ala Pro Gly Val Asn Glu Met Ile Arg Ile Tyr Val Ala Gln Lys  
850 855 860

Arg Lys Ile Gln Asp Gly Asp Lys Leu Ala Gly Arg His Gly Asn Lys  
865 870 875 880

Gly Val Val Gly Lys Ile Leu Pro Gln Glu Asp Met Pro Phe Leu Pro  
885 890 895

Asp Gly Thr Pro Val Asp Ile Ile Leu Asn Thr His Gly Val Pro Arg  
900 905 910

Arg Met Asn Ile Gly Gln Val Leu Glu Thr His Leu Gly Trp Leu Ala  
915 920 925

Ser Ala Gly Trp Ser Val Asp Pro Glu Asp Pro Glu Asn Ala Glu Leu  
930 935 940

Val Lys Thr Leu Pro Ala Asp Leu Leu Glu Val Pro Ala Gly Ser Leu  
945 950 955 960

Thr Ala Thr Pro Val Phe Asp Gly Ala Ser Asn Glu Glu Leu Ala Gly  
965 970 975

Leu Leu Ala Asn Ser Arg Pro Asn Arg Asp Gly Asp Val Met Val Asn  
980 985 990

Ala Asp Gly Lys Ala Thr Leu Ile Asp Gly Arg Ser Gly Glu Pro Tyr  
995 1000 1005

Pro Tyr Pro Val Ser Ile Gly Tyr Met Tyr Met Leu Lys Leu His  
1010 1015 1020

His Leu Val Asp Glu Lys Ile His Ala Arg Ser Thr Gly Pro Tyr  
1025 1030 1035

Ser Met Ile Thr Gln Gln Pro Leu Gly Gly Lys Ala Gln Phe Gly  
1040 1045 1050

Gly Gln Arg Phe Gly Glu Met Glu Val Trp Ala Met Gln Ala Tyr  
1055 1060 1065

Gly Ala Ala Tyr Thr Leu Gln Glu Leu Leu Thr Ile Lys Ser Asp  
1070 1075 1080

Asp Val Val Gly Arg Val Lys Val Tyr Glu Ala Ile Val Lys Gly  
1085 1090 1095

Glu Asn Ile Pro Asp Pro Gly Ile Pro Glu Ser Phe Lys Val Leu  
1100 1105 1110

Leu Lys Glu Leu Gln Ser Leu Cys Leu Asn Val Glu Val Leu Ser  
1115 1120 1125

Ala Asp Gly Thr Pro Met Glu Leu Ala Gly Asp Asp Asp Asp Phe  
1130 1135 1140

Asp Gln Ala Gly Ala Ser Leu Gly Ile Asn Leu Ser Arg Asp Glu  
1145 1150 1155

Arg Ser Asp Ala Asp Thr Ala  
1160 1165

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<212> DNA  
<213> Corynebacterium glutamicum

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tcggtaagg tcagtggcga gcttcttgc tggttcggtt ccttgaggaa cagtcatggg 180  
aaccattcta acaaggatt tggtgtttc tgccgcttagc tgataatgtg aacggctgag 240  
tcccactctt gtagttggga attgacggca cctcgcactc aagcgcggta tcgcccctgg 300  
tttccggga cgccgtggcg catgttgca tttgatgagg ttgtccgtga catgtttgg 360  
cgggccccaa aaagagcccc ctttttgcg tgtctggaca cttttcaaa tccttcgcca 420  
tcgacaagct cagccttcgt gttcgtcccc cgggcgtcac gtcagcagtt aaagaacaac 480  
tccgaaataa ggatggttc atg cca act att cag cag ctg gtc cgt aag ggc 532  
Met Pro Thr Ile Gln Gln Leu Val Arg Lys Gly  
1 5 10  
cgc cac gat aag tcc gcc aag gtg gct acc gcg gca ctg aag ggt tcc 580  
Arg His Asp Lys Ser Ala Lys Val Ala Thr Ala Ala Leu Lys Gly Ser  
15 20 25  
cct cag cgt cgt ggc gta tgc acc cgt gtg tac acc acc acc cct aag 628  
Pro Gln Arg Arg Gly Val Cys Thr Arg Val Tyr Thr Thr Pro Lys  
30 35 40  
aag cct aac tct gct ctt cgt aag gtc gct cgt gtg cgc ctt acc tcc 676  
Lys Pro Asn Ser Ala Leu Arg Lys Val Ala Arg Val Arg Leu Thr Ser  
45 50 55  
ggc atc gag gtt tcc gct tac atc cct ggt gag ggc cac aac ctg cag 724  
Gly Ile Glu Val Ser Ala Tyr Ile Pro Gly Glu Gly His Asn Leu Gln  
60 65 70 75  
gag cac tcc atg gtg ctc gtt cgc ggt cgt gtt aag gac ctc cca 772  
Glu His Ser Met Val Leu Val Arg Gly Gly Arg Val Lys Asp Leu Pro  
80 85 90  
ggc gtc cgt tac aag atc gtc cgt ggc gca ctg gat acc cag ggt gtt 820  
Gly Val Arg Tyr Lys Ile Val Arg Gly Ala Leu Asp Thr Gln Gly Val  
95 100 105

|  |   |      |
|--|---|------|
| aag gac cgc aag cag gct cgt tcc ccg cta cg                       | gaa gag ggg ata                             | 868  |
| Lys Asp Arg Lys Gln Ala Arg Ser Pro Leu Arg Arg                  | Glu Glu Gly Ile                             |      |
| 110  | 115   | 120  |
| att aaa aat gcg taaatcagca gtcctaagc gtccagtagt tcaggaccct       |   | 920  |
| Ile Lys Asn Ala  |   |      |
| 125  |   |      |
| gtataacaagt ccgagctcg  | tacccagctc gtaaacaaga tcctcatcg             | 980  |
| tccaccgcag agcgcatcg   | ctacggtgca ctcgagatct gccgtgagaa gaccggcacc | 1040 |
| gatccagtag gaaccctcg   | gaaggctctc ggcaacgtgc gtccagac              | 1100 |
| tcccgccgt  | gtgccagtgg atgtcgccc agagcgcgca             | 1160 |
| aacaccctcg cactgcgtt   | gttggttaacc ttcacccgtc agcgtcgta gaacaccatg | 1220 |
| atcgagcg   | ttgcaaacga acttctggat gcagccaacg gccttggcgc | 1280 |
| cgtcgcaag acacccacaa   | gtggcagag gccaaccgcg cttcgctca ctaccgctgg   | 1340 |
| tagtactgcc aagacatgaa  | agccaatca ccttaagat caacgcctgc cggccccc     | 1400 |
| cacatttcaa taagctggca  | gcctgcgtt cttcaaggcg actggcctt tagtctcatt   | 1460 |
| aatgcagttc accgctgtaa  | gatagctaaa tagaaacact gttcggcag tgtgttacta  | 1520 |
| aaaaatccat gtcacttgcc  | tcgagcgtgc tgcttgaatc gcaagttgt ggcaaaatgt  | 1580 |
| aacaagagaa ttatccgtag  | gtgacaaact ttttaatact tggtatctg tcatggatac  | 1640 |
| cccgtaata aataagtgaa ttaccgtaac caacaagttt ggttaccact gtggcacaag |   | 1700 |
| aagtgcctaa ggatctaaac aaggccgca acatccgcat catggcgcac atcgatgctg |   | 1760 |
| gtaagaccac gacca   |   | 1775 |

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 <212> PRT  
 <213> *Corynebacterium glutamicum*

<400> 8

Met Pro Thr Ile Gln Gln Leu Val Arg Lys Gly Arg His Asp Lys Ser  
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Ala Lys Val Ala Thr Ala Ala Leu Lys Gly Ser Pro Gln Arg Arg Gly  
 20 25 30

Val Cys Thr Arg Val Tyr Thr Thr Pro Lys Lys Pro Asn Ser Ala  
 35 40 45

Leu Arg Lys Val Ala Arg Val Arg Leu Thr Ser Gly Ile Glu Val Ser  
50 55 60

Ala Tyr Ile Pro Gly Glu Gly His Asn Leu Gln Glu His Ser Met Val  
65 70 75 80

Leu Val Arg Gly Gly Arg Val Lys Asp Leu Pro Gly Val Arg Tyr Lys  
85 90 95

Ile Val Arg Gly Ala Leu Asp Thr Gln Gly Val Lys Asp Arg Lys Gln  
100 105 110

Ala Arg Ser Pro Leu Arg Arg Glu Glu Gly Ile Ile Lys Asn Ala  
115 120 125

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<211> 24  
<212> DNA  
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<220>  
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24

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<223> SYNTHETIC DNA

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ggaaacgtcc atgtaatcaa

20

<210> 11  
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<220>  
<223> SYNTHETIC DNA

<400> 11  
aacacgcact acgacgaaga

20

<210> 12  
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<212> DNA  
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<220>  
<223> SYNTHETIC DNA

<400> 12  
cagcatcaag gtcgaaggttc

20